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MILTON WHITNEY, Chief of Bureau.

SOILS OF THE EASTERN UNITED STATES AND THEIR USE—II.

THE NORFOLK FINE SAND.

BY

JAY A. BONSTEEL

Scientist in Soil Survey.



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BUREAU OF SOILS.

MILTON WHITNEY, *Chief of Bureau.*

ALBERT G. RICE, *Chief Clerk.*

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W J MCGEE, in charge of Soil Water Investigations.

SOILS OF THE EASTERN UNITED STATES AND THEIR USE—II.

THE NORFOLK FINE SAND.

GEOGRAPHICAL DISTRIBUTION.

The Norfolk fine sand is distributed through the Coastal Plains soil province in both the Atlantic and Gulf regions from southern Virginia to eastern Texas. A total area of 1,595,072 acres of this type, occurring in 46 different areas located in 11 different States, has been covered by the detailed soil surveys of the Bureau of Soils. The Norfolk fine sand is found only within the Coastal Plain Province of the United States. It occurs at elevations which vary from just above sea level to an extreme altitude of about 350 feet. The greater part of the type lies at an elevation between 25 feet and 150 feet above sea level. It is found chiefly in the vicinity of tidewater and in the lower lying areas which extend back from 50 to 75 or more miles from the coast line. The total geographical extent of the Norfolk fine sand covers several million acres, as has been shown by the large area of this soil type encountered in the soil surveys which have already been made. The Norfolk fine sand is not essentially a strong general farming soil, but its particular adaptation to the production of early truck crops in regions where transportation to market is possible renders it an extremely important soil throughout the seaboard section.

CHARACTERISTICS OF THE SOIL AND SUBSOIL.

The surface soil to a depth of 8 or 10 inches is a brown, gray, or pale-yellow fine sand. It is usually loose and incoherent, although in its virgin state and in uncultivated fields it is liable to be somewhat compacted at the surface. The subsoil from an average depth of about 10 inches to a depth of 36 inches or more is a yellow or pale-yellow fine sand, which is always loose and incoherent. Below 3 feet this yellow fine sand usually grades into a fine sandy clay at varying depths. In fields which have been subject to clean cultivation for a considerable period of time the surface soil may be light gray or almost white in color. In newly cleared fields, or in those where care has been taken to maintain the organic matter content of the soil the surface coloration is usually brown or some shade of yellow.

The Norfolk fine sand thus possesses the color characteristics of all of the soils of the Norfolk series. The characteristic yellow color of the subsoil distinguishes this series from any of the members of the Portsmouth series which usually possess a black or dark-brown surface soil and a gray subsoil. Similarly it differs from the soils of the Orangeburg series, which may be associated with it, since the latter always possess red sandy clay subsoils at some depth.

The Norfolk fine sand is distinguished from the heavier members of the same series in that the yellow sandy clay which forms the subsoil of these other types is not usually encountered in the case of the Norfolk fine sand at a depth less than 36 inches. It is distinguished from the Norfolk sand in that it has a smooth fine sandy texture rather than the coarser, more gritty texture of the last-named type.

SURFACE FEATURES AND DRAINAGE.

The Norfolk fine sand occurs principally upon the uplands between the major stream drainages and at the lower elevations in the Coastal Plain Section. It is extensively developed in the "Flat Woods" Section from Virginia south to Alabama. It also occupies considerable areas in the timbered region of east Texas and west central Louisiana. The topography is usually gently rolling to ridged or somewhat hilly. The higher elevations are occupied by areas of the Norfolk fine sand, while intervening hollows and depressions are occupied either by heavier members of the Norfolk series, or by soils belonging to the Portsmouth or other soil series. The texture of the Norfolk fine sand and its topographic position give rise to excellent natural drainage, both in the soil and in the subsoil. It rarely, if ever, requires artificial drainage to supplement the natural conditions. In fact, there is a tendency toward excessive drainage throughout all the areas of the Norfolk fine sand, and this is particularly emphasized where the depth of the fine sand subsoil exceeds 4 or 5 feet. Such areas are most likely to be encountered upon the low ridges and hillocks which occur within the type.

LIMITATIONS OF USES.

The Norfolk fine sand is preeminently suited by its inherent soil characteristics to the production of early and medium truck crops. It is of but secondary importance, in all areas where it occurs, for the production of the staple general farm crops. The yields of the latter are invariably low, usually much lower than those secured upon the heavier types of the same series or of other associated series. The general field crops, which must depend upon a long-growing season and upon large yields per acre for their profitable production, are at a decided disadvantage when planted upon the Norfolk fine sand.

The soil is usually loose and incoherent, not over well supplied with organic matter, and in almost all cases so located with regard to topography and drainage that moisture is easily drained out from both surface soil and subsoil. As a result the longer-growing field crops during the later part of the summer experience serious difficulty from drought, and their yields are decidedly diminished. This is markedly the case with both cotton and corn. The average yields of cotton even under fairly good farming methods rarely rise above one-half bale per acre and frequently sink below one-fourth bale. With corn the yields may be as low as 5 to 8 bushels per acre, and they rarely rise above 20 bushels. The reason is the same in both cases. There is insufficient moisture supply to maintain steady, uninterrupted growth during the long summer period. These limitations do not apply as strongly to certain classes of crops like the garden vegetables, which depend for their greatest value upon early maturity.

IMPROVEMENT IN SOIL EFFICIENCY.

The Norfolk fine sand is not to be recommended in general for the production of the staple crops. It is sometimes necessary, however, for the farmer who possesses considerable areas of this soil type to plant cotton, corn, and other staples upon land of this character. In order that he may meet with even a fair measure of success it is necessary for him to exercise the greatest skill and judgment in so preparing his land as to tend constantly toward the absorption and retention of soil moisture. For this purpose it is desirable that the largest possible amount of partially decayed organic matter should be accumulated in the surface soil. Under normal conditions existing throughout the regions where the Norfolk fine sand is found, this is best accomplished by sowing some green-manuring or cover crop upon the land in the late summer or early fall of one year; by allowing it to make its growth during the latter part of the summer and early winter; and by plowing this under for incorporation in the soil during the early spring when the land is being prepared for the succeeding field crop. For this purpose cowpeas, crimson clover, and winter vetch have all proven their usefulness in the practice of the best farmers. The cowpeas may be planted about midsummer and allowed to make a good growth before frosts intervene. It is not essential that any peas should be developed or matured. It is the growth of forage which is desired. Crimson clover or winter vetch should be sown in the early autumn, and will make good growth south of Chesapeake Bay during the fall and winter months. If necessary, any one of the three crops may be partially grazed off as opportunity affords.

Some farmers have found it desirable when turning under a large mass of green vegetation to apply 2,000 pounds of burned stone lime per acre, in order to sweeten the soil and to carry through the thorough decomposition of the organic matter thus incorporated. Where this is omitted difficulties have sometimes ensued through the partial decomposition of the green crop turned in. Where lime has been applied in this connection, however, success has been almost invariable.

The partially decayed organic matter thus furnished acts as a sponge to absorb and retain moisture within the surface soil. As the succeeding crop pushes its roots through the soil particles, both organic and mineral, this stored-up moisture is encountered and becomes available for the production of the main staple crop. Improvement in the land may be secured by a single season of treatment of this kind, but the greatest improvement is always obtained where successive green crops are grown at least one year in three of the regular crop rotation and turned under to maintain the humus content of the soil. This method for increasing the moisture-holding capacity through the maintenance or increase of the organic matter in the soil is one of the prime essentials in the management of the Norfolk fine sand for the production of either general or special crops.

Wherever possible it is also essential that all yard and stable manures should be saved and applied to this soil. It is frequently desirable under certain conditions to compost and rot this manure and to apply it immediately in advance of the planting of the crop. If the stable manure is applied some time in advance of the planting of the crop it should be thoroughly harrowed into the surface soil, in order to prevent the evaporation of the liquid portion of the manure, particularly the ammonia. Only under unusual conditions should lime be used directly in connection with applications of stable manure.

TILLAGE REQUIREMENTS.

Those methods of soil tillage which tend to compact the subsoil and thus to render it more retentive of soil moisture are most desirable for the handling of this type. Consequently shallow to medium-deep plowing is rather to be recommended, and if it is possible to use the disk plow or disk harrow upon this type of soil rather than the moldboard plow or the spring-tooth harrow, the former type of machinery should be employed. These two essentials—the incorporation of organic matter and the packing of the soil—will serve to increase the crop yields, even of the general farm crops, although their planting upon the Norfolk fine sand can only be recommended

in case it is not possible through any circumstances to produce the more valuable and more intensively farmed garden vegetables and truck crops.

LIMITATIONS UPON SPECIAL CROPS.

Since the market garden and truck crops depend so largely for their value upon the earliness with which they can be brought to market, and also upon the fresh condition in which they can be marketed, it follows that areas of the Norfolk fine sand which are located near to good rapid transportation facilities will be far the most desirable for the production of the trucking crops. While railroad transportation is not absolutely essential, it is very desirable. On the other hand, rapid water transportation offers some advantages because of the freedom from jar which is given by this mode of transport to perishable products like fresh vegetables, melons, and tender fruits. Both means are employed for the shipment of large quantities of truck and fruit crops raised upon areas of Norfolk fine sand. Areas of the same type equally well suited in every other respect, except transportation, still remain in virgin forest or feebly occupied for the production of staple crops, while small areas of the Norfolk fine sand favorably located with regard to transportation have been developed to the production of the more intensively farmed special crops.

There is another factor besides transportation which enters into the production of the trucking crops upon the Norfolk fine sand along the Atlantic seaboard. This is the factor of favorable location with regard to local climatic differences. Those areas of the Norfolk fine sand which are located near tidewater, and particularly near the ocean, have a decided advantage in the protection from unseasonable frosts which is afforded by the presence of large bodies of water and by the off-shore presence of the Gulf Stream. Not only is the season during which plant growth may take place considerably lengthened on this account, but even in the months during which frost may occur extremely low temperatures are much more rare than in locations removed from proximity to tidewater, especially if the latter lie at considerable elevation. Thus not only the peculiarities of texture and of drainage of the Norfolk fine sand, but also the location of a considerable proportion of the type near to sheltering bodies of water, give rise to its particular adaptation to the production of early vegetables and market-garden crops. When to these advantages there may be added proximity to lines of rapid transit, almost ideal conditions for market-garden occupation arise.

It is not infrequently the case that the proximity to water transportation also enables the market-garden farmer or the trucker to secure, through means of cheap transportation, considerable quan-

tities of stable manure from cities located upon the same bodies of water. Since he is largely deprived of a home supply of organic manure from the nature of his farming operations and must depend upon purchased manures and fertilizers for use in his trucking business, this becomes of decided advantage wherever the opportunity exists.

The limitations upon special crop production, then, are limitations of adaptation of soil to crop, limitations of transportation facility, both to and from the fields, and limitations of favorable or adverse local climatic conditions. The special crop adaptations will be discussed at greater length in a succeeding section.

EXTENT OF OCCUPATION.

Since the Norfolk fine sand has been recognized in nearly all localities as a soil less favorable than many others for the production of general farm crops, it has not been cleared and cultivated to nearly the extent of areas of the Norfolk sandy loam or fine sandy loam or those of the Orangeburg sandy loam and fine sandy loam occurring in the same locations. In fact, except, under special conditions, a large proportion of the Norfolk fine sand has been left in the original growth of longleaf or loblolly pine, while areas which have once been cleared of this growth have been allowed to reseed to the loblolly pine or other species of timber.

However, where transportation to northern markets has been especially good, the areas of the Norfolk fine sand near to shipping points have been in great demand as the basis for the production of special trucking crops. Thus in eastern Virginia, in many portions of eastern North Carolina, and throughout the immediate coast section of South Carolina and Georgia, there have been established important trucking areas which have grown to be great shipping points for southern vegetables. Within easy hauling distance of all such transportation points, the Norfolk fine sand has been in such demand that practically every acre of it has been cleared and appropriated to the uses of the market gardener and trucker. While the acreage value of this type of soil, remote from transportation, and where general farm crops only may be produced, usually ranges from \$5 or \$6 an acre to not more than \$20 an acre, in the developed truck sections the value of the same type of soil for special purposes rises to \$150 or even \$250 an acre, depending largely upon the amount of this class of land available in the locality within easy hauling distance of the shipping point. In fact the type forms an excellent example of an extensive soil held in low esteem for general farming purposes, but, by contrast, held in high esteem for special uses where these are possible.

It is probable that not over 25 per cent of the entire area of the type which is located 15 miles or more from shipping points is under cultivation. It is also a fact that in the established trucking districts from 85 to 100 per cent of the type is intensively occupied, not for the production of a single crop in each year, but for the production of a rapid succession of crops frequently beginning with shipments of asparagus, peas, and beans, and following on through the year to terminate with the shipment of some staple crop which has been planted, grown, and harvested after an early truck crop has previously been taken from the land. The Norfolk fine sand thus furnishes an excellent example of a soil which but a few years ago was considered practically worthless for agricultural purposes, but which under special conditions, in restricted localities has come to have an abnormally high acreage value because of its peculiar and special crop adaptations. It may be said in this connection that as transportation facilities are extended, and as the demand for these special trucking crops increases, there will be made available thousands of additional acres of this type capable of producing good yields of the crops which are suited to it and which are in increasing demand for the feeding of city populations.

CROP ADAPTATIONS.

General farm crops.—The differences in crop adaptations between the different localities where the Norfolk fine sand occurs are not so directly dependent upon the climatic surroundings of the soil as in the case of the heavier members of the Norfolk series. Throughout the entire extent of the type from southern Virginia to eastern Texas the Norfolk fine sand is planted to small areas of corn. The type is not well suited to the production of this crop, and the yields secured are universally low, ranging from 5 to 20 bushels per acre. The Norfolk fine sand is too porous and well drained to maintain a sufficient moisture supply for the production of large corn crops. Similarly the yields of winter oats, which are sown as a cover crop upon some portions of the type, are generally low. In connection with other crops cowpeas are grown to a limited extent south of Virginia. Since one of the greatest needs of the Norfolk fine sand is the incorporation of additional organic matter, the sowing of cowpeas with the corn crop might well be extended throughout the entire area of this type. The peas should be used as a forage crop with the corn, while the roots and stubble should be incorporated with the soil. Velvet beans take the place of cowpeas locally in south Georgia and Florida, and might also be produced upon the Norfolk fine sand to advantage in southern Alabama and Mississippi. The Norfolk fine sand is used only to a limited extent for the pro-

duction of peanuts in eastern North Carolina and in northeastern Texas. The crop can be grown to advantage as a basis for hog feeding and to restore organic matter to the soil. The Norfolk fine sand is occasionally used for the production of the bright cigarette tobacco in eastern North Carolina, but the yields are generally low, not exceeding 500 or 600 pounds per acre, and the type is not particularly well suited for the production of this crop.

The Norfolk fine sand over its cultivated areas is almost universally planted to cotton south of the Virginia line. The yields in general are low, ranging from one-fourth bale to one-half bale per acre, and except where areas of the type depart from the normal condition, and through topographic position or the near approach of heavier underlying materials to the surface become more retentive of moisture, it can scarcely be recommended as a good cotton soil. In southern Georgia, northern Florida, and the southern portions of Mississippi and Alabama, some ribbon cane is grown for the production of table sirup. The yields are only moderate, but the quality of the sirup produced is superior.

Truck crops.—The most important and the proper use made of the Norfolk fine sand in any of the localities where it occurs is that of the production of early vegetables for the northern markets. The trucking industry has been quite widely developed upon such areas of the Norfolk fine sand as are suitably located near to means of rapid and easy transportation to market. Quite a wide variety of early truck crops may be produced upon this soil, and upon the best-managed truck farms a continuous succession of crops may be planted and harvested throughout the earlier part of the vegetable shipping season.

The Norfolk fine sand is the earliest winter and spring truck soil along the South Atlantic and Gulf coasts, which at the same time is sufficiently retentive of moisture to assure the maturity of medium to large yields per acre. The type thus combines the essential element of forcing the crop to an early maturity, and the equally essential capability of producing fair to large yields of the crop when the soil is properly managed and fertilized.

Early Irish potatoes constitute one of the most important trucking crops produced upon the Norfolk fine sand. From northern Florida to eastern Virginia this crop is produced chiefly for early northern markets, and the different localities where trucking is established furnish a succession of shipments beginning with those from Florida points. From the more southern locations, potatoes are shipped from the middle of April until about the first of May. The crop matures about one week later for each 100 miles to the northward from the most southern trucking districts. Thus eastern Georgia ships early Irish potatoes grown upon this type as early

as the 10th of May, and continues the shipments for about one month. Eastern South Carolina and the seaboard points in North Carolina follow successively and the Norfolk region in Virginia begins the shipment of potatoes during the first or second week in June. The crop is also grown upon the same or similar soils on the eastern shore of Maryland, in Delaware, and in southern New Jersey, thus continuing the period during which potatoes are produced for the early summer market. The last of the market garden crop in the more Northern States is harvested immediately before the general field crop raised throughout these States begins to mature and to be ready for market.

In the handling of the Norfolk fine sand for the production of early Irish potatoes it is particularly essential that large quantities of well-composted stable manure should be applied to the soil well in advance of the planting season. It is also desirable that the soil should have been occupied previously by some leguminous cover crop, either cowpeas, winter vetch, or crimson clover being available for this purpose. From these two sources of organic matter—the green crop plowed under, or the well-composted stable manure, or both—a fine loamy condition of the surface soil is produced, which aids in the retention of the requisite moisture supply without interfering with the warming up of the soil or with its production of an early crop. In addition to the organic matter thus incorporated the best growers use 1,000 pounds or more of a high-grade commercial fertilizer which will analyze from 4 to 8 per cent of potash and from 6 to 7 per cent of nitrogen. The usual amount of phosphoric acid, ranging from 8 to 10 per cent, is also carried by these fertilizers. There is a tendency on the part of many growers to prefer the sulphate of potash to any other form for the production of the potato crop. Nitrate of soda frequently supplies the nitrogen, although sulphate of ammonia goods are quite generally used by successful growers.

The Norfolk fine sand is also well suited to the production of sweet potatoes, either as an early truck crop in the more northern locations, or as a staple farm crop for marketing throughout the year in all locations from Virginia southward. The sweet potatoes are started in cold frames and transplanted to the field after the soil has been prepared by turning in a good supply of well-rotted stable manure in the bottom of the trench. This is covered lightly with the surface soil and the plants are set in the soil. This method is general for forcing the earliest sweet potatoes to maturity. The commercial fertilizers are also used with this crop, but to a more limited extent than with the early Irish potatoes. Yields of 100 to 150 bushels per acre of the sweet potatoes are secured with good management. For the later general crop, sweet potatoes may follow upon the same

land from which the early crop of Irish potatoes has been harvested, and many of the growers claim that the heavy fertilization for the early Irish potato crop also proves decidedly advantageous in the production of the later field crop of sweet potatoes. The Norfolk fine sand is one of the best sweet-potato soils throughout the Atlantic seaboard section, and is also used for the production of this crop in eastern Texas. At intermediate points only a small acreage is planted for local home consumption, principally upon the farm where it is grown.

The Norfolk fine sand is used in the more northern locations along the Atlantic seaboard for the production of early tomatoes as a trucking crop. The plants are transplanted from cold frames into the field, and the crop is ready to be picked for market during the latter part of June and early in July. Frequently any excess of the crop over market demands may be sold to canning factories. The yields per acre depend largely upon the care with which the land has been prepared and upon the skill of the grower. Yields of 8 to 10 tons per acre are not infrequent.

Snap beans and early garden peas are produced upon the Norfolk sand in nearly all of the Atlantic coast trucking sections. In the more southern regions the beans are planted during February and the first pickings are made late in April or early in May. In the more northern regions the dates of planting and picking are correspondingly later. The beans are marketed chiefly in 3-peck baskets, and the earlier part of the crop usually brings from \$2.50 to \$3 a basket. Whenever the cost of shipment approaches two-thirds of the price received, marketing is discontinued. Peas are handled in about the same way. With both of these crops a later farm crop, either for forage purposes or in some cases sweet potatoes for home use, may be grown after the peas or beans have been removed.

In the Norfolk district cucumbers are also produced upon the Norfolk fine sand. In this region the Norfolk fine sand is the earliest truck soil in the area, and practically all of it is in a high state of cultivation. The cucumber crop is usually planted alongside the rows of early peas, in ridges close to the peas. Before the cucumbers reach an advanced stage of growth the peas have been harvested and are out of the way. It is usual for the best truckers to make three or four separate plantings of cucumbers from a few days to a week apart. In this manner they insure against damage from drought, from insect pests, or from any of the fungus diseases which might develop. If the earlier plantings are made with unfavorable conditions, the later plantings are liable to succeed, or the reverse may be the case. Cucumbers are marketed also in 3-peck baskets and the

earliest shipments may sell at a price of \$2 a basket or even better. When the price sinks to 75 cents a basket shipment usually ceases. The yield of this crop per acre is decidedly variable, but the best growers count upon 200 or more baskets per acre as a fair crop. In the more northern regions the Norfolk fine sand is probably the best soil for cucumber growing.

While the Norfolk fine sand is probably exceeded in value by the Norfolk sand for the production of extra-early asparagus, still the former soil type is well suited to the production of this crop, and it has been grown to considerable extent as one of the most valuable of the early spring crops. In order to secure deep rooting of the plants the ground is trenched out to considerable depth and the roots are placed in the bottom of the trench. As the plants grow the intervening ridges are hilled up against the growing plants until the plants themselves occupy the ridge and the soil between the rows has been moved out until hollows or furrows intervene. Heavy fertilization is practiced with stable manure scattered in the bottom of the trenches and commercial fertilizers applied in the row, the latter being applied both at the time of transplanting and at succeeding periods during the first year's growth of the asparagus. Small applications of nitrate of soda from time to time have been found particularly efficacious in forcing the growth of the asparagus.

The Norfolk fine sand is admirably suited to the production of both cantaloupes and watermelons. It is remarkable that so little attention has been paid in the majority of trucking regions to the production of these crops upon this type of soil. For cantaloupes few better soils may be found in the Coastal Plain region, since the Norfolk fine sand is sufficiently well drained to minimize the danger from fungus diseases; it is sufficiently retentive of moisture to produce a good growth of vine; and it is sufficiently warm and early to give not only early maturity to the crop, but also sweetness and flavor to the melons. It requires heavy applications of both stable manure and commercial fertilizer to produce the heaviest yields, but is capable of rewarding such care with excellent crops.

The most advanced growers of cantaloupes start the plants in individual pots or small cans in cold frames and transplant these to the field as soon as danger from frost has passed. This is accomplished without disturbing the root growth, and there is no check to the growth of the plants. In this manner the maturity of the vines and melons may be advanced from 10 days to 2 weeks over that of the cantaloupes planted directly in the same field. Of course, only a small acreage may be handled in this manner, since the attendant expense is very great. It is, however, used by growers who desire to

place extra-early melons upon the market and to follow these by the later field-planted crop. The Norfolk fine sand is also well suited to the production of watermelons, and this crop is raised to some extent, particularly in the Texas regions where the soil type is developed. As in the case of cantaloupes, the watermelons produced upon the Norfolk sand mature somewhat earlier than those upon the Norfolk fine sand. For this reason in the more northern areas the sand is usually chosen for the production of both classes of melons.

Lettuce and cabbage are of secondary importance as crops for the Norfolk fine sand. The moisture-holding capacity of the type is hardly sufficient for the production of these crops under normal circumstances, and the organic-matter content is also rather low.

It will be seen from the above consideration that there are nine important and valuable special truck crops which may be produced for the early market upon the Norfolk fine sand wherever it occurs in sufficient proximity to lines of rapid transit, so that the crops produced may be transported in quick time from the field to the market sought. In the more northern trucking regions the early Irish potatoes, early sweet potatoes, cucumbers, and tomatoes have thus far been the more important crops produced upon the Norfolk fine sand. Farther south asparagus, peas, beans, cantaloupes, and watermelons have been grown in addition to these crops, while in some areas attempts have been made with moderate success to produce lettuce and cabbage upon the type.

In the north Florida region the shade-grown Sumatra tobacco is sometimes produced upon the Norfolk fine sand, but the best success with this crop is only attained upon this soil type when irrigation can be practiced.

SUMMARY.

The Norfolk fine sand occurs throughout the Atlantic and Gulf Coastal Plain regions from Virginia to eastern Texas. In general it lies at low or intermediate elevations above sea level, not exceeding 350 feet, and its surface is undulating, rolling, or hilly.

The surface soil is usually a gray fine sand, the subsoil a fine sand of some shade of yellow.

It is loose, porous, well drained, and warm.

Because of its physical texture, its elevation above drainage channels, and the lack of any heavier underlying material at a depth of less than 3 feet, it is liable to be excessively drained and not sufficiently retentive of soil moisture to be able to produce the best results with general farm crops.

The same characteristics, however, render it warm and early, and constitute the Norfolk fine sand an admirable soil for the production of early truck crops wherever transportation to northern markets

is available, and particularly where proximity to the ocean or other large bodies of water exerts a favorable influence upon the local climatic conditions.

It is one of the principal soils for the production of early Irish potatoes, sweet potatoes, tomatoes, garden peas, snap beans, cucumbers, cantaloupes, watermelons, and early asparagus.

It has a secondary value for the production of lettuce and cabbage.

It can be utilized for the production of the shade-grown Sumatra tobacco, in southern Georgia and northern Florida, only when irrigated.

It requires for its improvement the incorporation of additional organic matter through the production and plowing under of cow-peas, vetch, crimson clover, peanuts, or velvet beans.

It is improved by the application of well-rotted and composted stable manures, both for general farm crops and for the production of truck crops.

Its rather low yield of the general farm crops under normal conditions has resulted in leaving extensive areas more remote from transportation facilities unoccupied and uncleared of the original timber growth or second growth.

Its recognition as a special trucking soil has led to a high demand for occupation by market-garden and truck crops for all early Norfolk fine sand favorably located to transportation.

As the demand for southern-grown vegetables increases with the increased growth of northern city populations, additional areas of the Norfolk fine sand will be required for the production of these crops, and additional transportation facilities will undoubtedly be afforded to carry them to the markets. With this increase in demand for the special products of this soil and with increased transportation facilities, additional areas of the type may successively be brought under cultivation and its present acreage price decidedly increased.

APPENDIX.

The following table shows the extent of the Norfolk fine sand in the areas surveyed to this time.

In the first column is stated the particular soil survey in which the soil was encountered; in the second column, its extent of development in acres; and in the third column, the particular volume of the Field Operations of the Bureau of Soils in which the report upon the area may be found. Those desiring a detailed description of the soil and of the general conditions which surround it in any particular area may consult these volumes in almost any public library:

Areas of the Norfolk fine sand encountered in the soil survey.

Survey.	Area of soil.	Year of publication, Field Operations.
Alabama:	<i>Acres.</i>	
Baldwin County	141,632	1909
Butler County	23,296	1907
Coffee County	43,648	1909
Dallas County	23,872	1905
Montgomery County	9,856	1905
Perry County ¹	4,160	1902
Florida:		
Escambia County	2,496	1906
Jefferson County	17,344	1907
Leon County	28,608	1905
Marianna area	10,816	1909
Georgia:		
Grady County	24,320	1908
Hancock County	7,104	1909
Thomas County	3,264	1908
Waycross area	27,776	1906
Louisiana:		
Caddo Parish	17,344	1906
Lincoln Parish	896	1909
Ouachita Parish	192	1903
Winn Parish	5,504	1907
Maryland:		
Worcester County	22,400	1903
Mississippi:		
Biloxi area	56,896	1904
Jackson area	320	1904
Scranton area	3,648	1909
New Jersey:		
Trenton area ²	1,408	1902
North Carolina:		
Chowan County	28,032	1906
Craven area ¹	76,672	1903
Duplin County	117,440	1905
Edgecombe County	4,608	1907
New Hanover County	21,056	1906
Pasquotank and Perquimans Counties	6,976	1905
Pitt County	8,448	1909
Robeson County	9,280	1908
South Carolina:		
Charleston area	61,504	1904
Conway area	68,480	1909
Texas:		
Anderson County	138,880	1904
Bastrop County	94,784	1907
Camp County	4,864	1908
Franklin County	18,560	1908
Henderson area	58,432	1906
Houston County	79,872	1905
Jacksonville area	28,528	1903
Lee County	41,856	1905
Morris County	9,408	1909
Robertson County	27,776	1907
Titus County	11,136	1907
Wilson County	68,032	1907
Virginia:		
Norfolk area ¹	20,864	1903

¹ Mapped as Norfolk sand.

² Mapped as Westphalia sand.



